RISK MANAGEMENT STRATEGY

SANDY SMELTERS PROPOSED NPL SITE

RISK MANAGEMENT OBJECTIVE

The overall objective in developing a risk management strategy for the Sandy Smelters site is to protect human health and the environment and to maintain that protection over time. This paper addresses human health only. EPA considered both the current use of the site as well as the reasonably anticipated future use in developing this strategy. EPA intends that the risk management strategy for the site will be protective of exposed individuals currently and in the future.

RISK ASSESSMENT APPROACH

EPA completed a Preliminary Endangerment Assessment (PEA) for the Sandy Smelters proposed NPL site in December, 1995 (EPA, 1995). Currently, the zoning categories of the properties within the study area boundaries for the Sandy Smelters site are single family residential, multi-family residential, low to moderate intensity commercial, hospital, open space, and industrial. The predominant current land use is single family residential. The areas of the site which are zoned commerical, industrial, open space, and hospital uses are surrounded by residential use. Therefore, EPA assumes that the reasonably anticipated future land use for the Sandy Smelters site is residential.

The PEA assessed the risks resulting from potential exposures to lead and arsenic in soils to residents within the Sandy Smelters study area. The exposed population considered in the arsenic risk assessment consisted of both children and adults within the study area. The exposed population considered in the lead risk assessment consisted of 126 children under seven years old currently residing within the study area and an assumed population of 85 additional children residing at randomly selected homes in the study area. The total population of children under seven years old considered in the Sandy lead risk assessment was 211.

RISK ASSESSMENT RESULTS

Arsenic Risks

The risks associated with exposure to arsenic in soil are summarized in the attached Table 9 excerpted from the PEA (attachment 1). Current EPA policy, summarized in OSWER Directive 9355.0-30, states that where the cumulative carcinogenic site risk to an individual based on the reasonable maximum exposure for both current and future land use is less than 10^{-4}, and the non-carcinogenic hazard quotient is less than 1, action is generally not warranted (EPA, 1991). Using this criteria, the cancer and non-cancer risks associated with exposure to arsenic in soil to

residents within the Sandy smelters site study area are predicted to be below a level of concern to EPA (i.e., not warranting remedial action).

Lead Risks

The health risks associated with exposure to lead are evaluated in a different manner than those associated with exposure to arsenic. Risks from lead exposure at the Sandy Smelters site were calculated using EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model. The health effect of most concern associated with lead exposure is the impairment of the nervous system, especially in young children and unborn children. Analyses conducted by the Centers for Disease Control and Prevention and EPA associate levels of lead in the blood of 10 micrograms per deciliter (ug/dL) and higher with health effects in children. EPA's risk management goal for lead is to achieve a level of protectiveness such that a typical child or group of similarly exposed children would have an estimated risk of no more than 5% of exceeding the 10 ug/dL blood lead level (EPA, 1994). Results of lead risk assessments are reported as the probabilities of exceeding the risk management goal.

The health risks associated with exposure to lead in soils at the Sandy Smelters site are reported as risks to individual children summarized in the attached Table 10 from the PEA (attachment 2) and risks across the community summarized in the attached Table 12 from the PEA (attachment 3). The results show that 108 of the 211 individuals assessed using the IEUBK model are predicted to have a probability of greater than 5% of having blood lead levels exceeding 10 ug/dL. 15 of these individuals reside at homes where soil was removed by EPA in time critical removal actions implemented in the period 1994- 1995. A total of 40 yards were remediated (soil removed and replaced with clean fill) within the study area during this time period. Table 12 shows the resulting neighborhood risk after these removal actions were completed. The IEUBK model results predict that no more that 8.1% of the population of children within the neighborhood will have blood lead levels exceeding 10 ug/dL. Both the individual risk and the neighborhood risk were considered in developing a risk management strategy for the Sandy Smelters site.

RISK MANAGEMENT

EPA generally uses the results of the risk assessment, in this case the PEA, to establish the basis for taking or requiring remedial action using authority provided by the Comprehensive Environmental Response Compensation and Liability Act. The risk assessment results are useful in identifying areas for which response alternatives need to be developed and evaluated. Concurrent with identifying areas potentially requiring action, medium specific (in this case soil) chemical concentrations are developed which are protective of human health and serve as goals for the response action within these areas. These chemical concentrations are called "preliminary remediation goals" (PRGs). They help focus the development of response alternatives.

Since the risk associated with exposure to arsenic at the Sandy smelters site was determined to be within the range of what EPA considers to be acceptable, PRGs were not developed for arsenic. EPA developed soil lead PRGs for the Sandy Smelters Site which are based on residential use and are protective of children.

As stated in the attached memorandum from Dr. Susan Griffin, EPA toxicologist (attachment 4), a single PRG for lead can be estimated by a back-calculation of the IEUBK model used in the baseline risk assessment. However, such a point estimate does not reflect the uncertainty and variability inherent in the risk assessment process. To capture and illustrate this uncertainty and variability, Dr. Griffin calculated a range of PRG values which reflect the variability surrounding estimates of soil ingestion rates of children. All other parameters of the model were kept as point estimates. In response to comments received from ASARCO, Inc. on the draft baseline risk assessment for the Murray Smelter Proposed NPL site, EPA also revised the dietary lead intake values and incorporated the revisions into the lead PRG calculations. The dietary lead intake revisions are based on recent FDA data. The resulting range of PRGs presented in Dr. Griffin's follow up memo of is 890 ppm - 1800 ppm (attachment 5).

Any lead concentration in soil within the range calculated using the Integrated Exposure-Uptake Biokinetic (IEUBK) model represents the same level of protectiveness for residents within the Sandy Smelters site given the inherent uncertainty in our ability to predict exposures and risks using this model.

Risk management for this site is the process of evaluating physical conditions, demographics, and any relevant health information to determine the appropriate remediation goal for each residence with the range of possible PRGs. The specific factors considered in making this determination for each property were, the likelihood of exposure to soil (measured qualitatively by ground cover), geochemical speciation/ bioavailability information, exposure unit considerations, and empirical evidence of exposure to lead. Each of these factors is discussed below.

Ground Cover

EPA considered the presence and condition of ground cover in evaluating the likelihood of exposure to children. Adequate ground cover that is well maintained reduces the likelihood of exposed soil and thus the possibility of children coming into contact with lead in the soil. Alternatively, poor ground cover may indicate an increased likelihood of exposure to soil and thus lead. The greater the likelihood of exposure, the lower the PRG should be (within the established range) in order to ensure protectiveness. A high percentage of the residential lots in the Sandy Smelters study area have yards with well maintained lawns with adequate ground cover. This suggests that a PRG toward the upper end of the established range is appropriate.

Geochemical Speciation/Bioavailability Information

As noted in the PEA, there is uncertainty about whether all forms of lead are equally absorbed in humans during passage through the gastrointestinal tract. The range of lead PRGs calculated for the Sandy Smelters site used a default value of 30% bioavailability. Geochemical speciation information about the soils within the study area shows that slag is the geochemical species found at the greatest frequency with lesser amounts of iron lead oxide, lead phosphate, and cerrusite. Since slag is relatively insoluble and contains very small amounts of lead by mass, the soil within the study can be expected to be less bioaccessable and perhaps less bioavailable then the 30% default assumption used in the calculation of PRGs using the IEUBK model.

Additional information to support this assertion is contained in the attached mineralogical profiles of soils from the Sandy Smelters site (attachment 6) and the Leadville site (attachment 7). The profiles are similar. Specifically, the profiles show that, like the Sandy soils, the soils at Leadville are characterized by slag and iron lead oxides. The soil at the Leadville site has been tested in an in vivo swine bioavailability study (EPA, ...) and absolute bioavailabilities between 25% and 30% were found. This information further supports the assumption that the bioavailability of lead in soils at the Sandy site may be less that the default assumption of 30% and consequently that a PRG at the upper end of the range calculated using the default assumption will be protective of ~~the exposed population~~ RESIDENTS at the Sandy site.

Exposure Unit Considerations

Tables 10 and 12 for the PEA suggest that while lead levels in soils of individual homes are predicted to cause health effects, on a community level, the risks are only slightly above EPA's health goals and may even be acceptable. For infants and toddlers, the risks predicted from exposure to individual yards are most relevant based on the concept that young children receive most of their exposure to lead in and about their homes. Older children however, are sufficiently mobile and are more likely to visit neighbor's homes, area playgrounds, daycare centers, and schools. Thus the blood lead levels of older children may be influenced not only by concentrations of lead at their residences but by neighborhood sources as well. If the neighborhood sources contain less lead, this could mean a decrease in the actual level of blood lead compared to IEUBK model predictions. The marginal risks calculated at the neighborhood level in Sandy suggest that a PRG at the upper end of the established range would be sufficiently protective.

Empirical Evidence of Lead Exposure

~~As described in the PEA~~, in 1994, the University of Cincinnati (UC) conducted a blood lead study in which blood lead samples and environmental data on lead in soil, dust, and tap water were collected for 118 children less than 7 years old residing in the Sandy Smelters study area. Quality control results of the study were reviewed by the Centers for Disease Control and Prevention (CDCP) and were found to be satisfactory. EPA Region 8 believes that study was conducted

according to CDCP guidelines as well as criteria specified in the EPA Region 8 risk assessment guidance RA-07, Blood Lead Evaluation.

The results of the environmental sampling conducted in the 1994 ~~University of Cincinnati~~ UC study show that 14% of the homes had measured soil lead concentrations > 1000ppm, 4% of the homes had measured soil lead concentrations > 2000 ppm, and 1% of the homes had measured soil lead concentrations > 4000 ppm. This compares well with the results of soil sampling conducted by EPA and used in the PEA. Of the homes sampled by EPA, 16% had measured soil lead concentrations > 1000 ppm, 3.6% of the homes had measured soil lead concentrations > 2000ppm, and 1% of the homes had measured soil lead concentrations > 4000 ppm. EPA concludes that the study population chosen for the ~~University of Cincinnati~~ 1994 UC study was reasonably representative of the Sandy Smelters site.

The geometric mean blood lead level in the 1994 UC study was 3.1 ug/dL and none of tested children had a blood lead level exceeding 10 ug/dL. As described above, the PEA conducted by EPA predicted 8% of the population with blood lead levels greater than 10 ug/dL, using the IEUBK model. In situations such as this, where there are discrepancies between measured blood lead levels and IEUBK model predictions, Region 8 guidance recommends that the reasons for the discrepancies be investigated and taken into account in the risk management process. Each of the factors discussed above could be possible contributors to the discrepancy.

While the 1994 UC University of Cincinnati study was not a determining factor in selecting a PRG for the Sandy site, it was considered by EPA. The study suggests that lead exposures at the Sandy Smelters site do not result in the elevations of blood lead levels which we expected from the results of the IEUBK model. The IEUBK model predictions are higher than the actual measured blood lead levels from the 1994 study. Still, in accordance with EPA policy, the IEUBK model was used to establish the PRG range and was not adjusted based on the 1994 study results. The information about measured blood lead levels suggests to a risk manager that a PRG at the upper end of this range may be adequately protective.

Considering all of the above factors, EPA has determined that a lead PRG of 1800 ppm is appropriate for residential properties in the Sandy Smelters study area.

It should be noted that the semi-quantitative uncertainty analysis and the resulting risk management strategy for lead at the Sandy Smelters site may not be appropriate for every site. The exposure patterns of individuals at different sites may be quite different. Evidence such as blood lead data from a well designed and well conducted blood lead study in conjunction with site specific environmental data can be useful in evaluating risk to children from lead. Such study results which indicate elevated blood lead levels in areas with soil lead levels

within an acceptable PRG range may be justification for a PRG at the lowest end of the range.

References

EPA, 1991. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. Washington, D.C. OSWER Directive 9355.0-30. April 22, 1991.

EPA, 1994. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. Washington, D.C. OSWER Directive 9355.4-12. July 14, 1994.

EPA, 1995. U.S. Environmental Protection Agency, Region 8. Final Evaluation of the Risk from Lead and Arsenic, Sandy Smelter Site, Sandy, Utah. December, 1995.

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